Teton Basin Beaver Inventory

Summer of 2000

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For

The Caribou Targhee National Forest

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Executive Summary

The genesis for this project began with a Watershed Analysis that was conducted on the Teton Basin Ranger District encompassing the Grandview area of the Big Holes southward to Pole Canyon. Water quality was identified as an issue relating to sedimentation and stream function. Past surveys indicated that a loss of beaver might have contributed to the decline of stable functioning streams in some drainages. A key question was identified asking what is the status of the beaver populations and the trends of those populations.

Beaver are a key species in maintaining the integrity of flat expanses of willow bottoms that evolved within relative narrow canyon bottoms. These flat willow bottoms were formed over decades and centuries as beaver dams trapped fine sediment and these fine sediments were stabilized by willows. If beaver or willows that formed these systems are removed and there is a lack of sources of large cobble, boulders, large wood, or bedrock to resist downward erosion these streams become susceptible to downward erosion and confinement of the floodwaters to within the stream channel (entrenchment). Once these systems become entrenched, they can convert rapidly from a Rosgen C or B-type gently meandering stream to a Rosgen G-type gully stream releasing stored sediment.

Trapping of beaver is purported to be a non-issue due to low pelt prices. Trapping, however, is likely to be more traditional than economic as such is the case with hunting and fishing enthusiasts. Documented trapping has occurred in Trail Creek by an experienced trapper as evidenced by a cleanly pelted carcass. In areas where there is good access, low numbers of beavers, and degrading stream conditions limit stability, the benefits of closing or more closely regulating trapping warrants evaluation.

During the summer of 2000, surveys were conducted on approximately 80 miles of streams draining into the Teton River to determine areas where introducing beavers or enhancing current populations could help improve riparian and hydrologic conditions.

By improving riparian and hydrologic conditions, fish habitat could improve, late summer flows increased, erosion and channel degradation could be reduced, and sediment storage could be increased. Information regarding landowner concerns and potential problems associated with the introduction of beavers needs to be gathered and evaluated before any actions are taken.

The streams to be surveyed were broken into half-mile units; each unit was walked in its entirety where possible or warranted. A Beaver Transplant Compatibility Matrix form was completed for each unit to assess the feasibility of introducing beavers to an area based on social, biological/ecological, and habitat suitability parameters.

Adherence to Forest Plan guidelines for the following parameters were also evaluated: bank stability (>80%), stream temperature (<16 ^{0}C), woody debris frequency (> 20 pieces/mile), and pool frequency (1 to every 5-7 channel widths).

Spawning gravel was also sampled in many streams to determine the levels of fine sediment (sediment < .2-8 mm). Sites sampled were determined after walking the entire stream, noting where the best gravels were, and sampling these areas.

Recommendations and Findings

North Moody Creek was observed to have a film of fine sediment deposited on the margins and out towards the middle of the stream indicative of a higher than normal sediment load. The following parameters were also not meeting expected values: temperatures of 23.5 ^{0}C, four units had banks that were less than 80% stable, pool frequency was also less than expected. North Moody is recommended for beaver transplants after grazing issues have been resolved.

Milk Creek bank stability is rated at 60% with evidence of repeated overgrazing for several years based on the utilization and form of the willows. Under proper management, this could be a future introduction site.

South Fork of Packsaddle is a site recommended for re-introduction. In 1988, there was a "successful" effort to eradicate beaver from this drainage. Units 4 and 5 in this drainage are the sites of an inactive but still stable complex of dams. Re-introduction is recommended to ensure the continued stability of this site and allow further expansion of the beaver complex and riparian zone.

The mainstem of **Horseshoe Creek** is suffering from active erosion and bank instability, and the channel has entrenched 2-4 feet. A wide valley bottom and dense willows make this excellent beaver habitat. There is currently one complex of nine dams on the mainstem at the Forest Boundary that was built this fall. If these dams do not withstand spring runoff reinforcement of dams will need to be considered. There appears to be enough habitat for two more complexes on the mainstem. Spot data indicates that water temperatures may exceed 16 ^{0}C.

A stream capture event was also documented 100 yds upstream of the confluence of the South Fork and Horseshoe Creek. A culvert has failed and an old road has captured the stream channel. Severe erosion is occurring in about 150 feet of channel due to unauthorized ATV use.

Mahogany Creek is highly unstable in the lower half of Unit 1 due to removal of beaver in an effort to control collection of water at the diversion. Re-colonization of beaver in this area would be beneficial in restoring stream stability. Options need to be evaluated to determine if there are measures that could be taken to meet the needs of the irrigators to divert water and still maintain channel stability. The **North Fork of Mahogany** is a site where introduction is recommended due to entrenchment and potential beaver migration barriers.3

Patterson Creek is recommended for introduction in Units 1 and 2. Bank stability in this stream is low at 75-80%. Overgrazing along this stream is evidenced by browsed willows, bank instability, and forb dominated meadows. There are also numerous trail crossings with related instability.

Little Pine Creek has a healthy beaver complex in Unit 1. Unit 2 has an abandoned beaver complex with a headcut that has proceeded upstream 800' and is now 6' deep. For the time being the headcut has been arrested at the site of an old beaver dam. Without beaver activity at this old complex, the headcut will continue to migrate upstream. Unit 2 had a bank stability rating of 75%. A high temperature of 16 ^{0}C was recorded indicating the guidelines are probably exceeded.

Trail Creek has been impacted by road construction including straightening in several areas some of which have caused entrenchment. In addition, culverts draining inside ditches on the pass itself are causing gullies on the fill slopes with the resultant fine materials being deposited into trail creek. There are two known sites where single beaver dams occur. As previously mentioned at least one beaver was trapped this fall. Introduction of beavers is recommended, as there are no beaver complexes present or signs of reproducing family units. Units 4 and 5 are the best sites for introduction.

Mail Cabin Creek has been captured by a road or trail at its confluence with Trail Creek and is contributing sediment. This site needs to be evaluated for repair.

Sediment with particle sizes below 8 mm have been shown to impede emergence of fry. Samples that had a cumulative percent by weight that averaged above 25% for particles smaller than 4 mm were considered to be spawning impaired with sediment levels likely above natural levels. Bjornn (1991) reports declines in emergence of young fish for increasing levels of sediment, at 20% (85-55% survival) and significant declines at 30% sediment (15-60% survival) and virtually no survival above 40% sediment (0-5% survival). The following streams had sediment levels above 25% for at least some of the

portions we sampled: Packsaddle, Horseshoe, North Twin, Mahogany, Trail, and North Leigh Creeks.

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Introduction

During the winter of 1999-2000, an assessment was made of the condition of the watersheds on the east side of the Bigholes from Grandview point southward to Pole Canyon. This assessment was done by reviewing the existing information on file with the Forest Service and through public comment. It was noted that some streams were eroding downward leaving raw vertical banks exposed. These degraded conditions were linked to both past and present uses, primarily grazing, mining, recreation use, and lack of beaver in valley bottoms where there dam building activities had helped form and maintain them.

As a result of this finding the Forest Service proposed an inventory to assess the general condition of the streams on the Targhee National Forest that are tributaries to the Teton River and their suitability or need for beaver reintroduction. Surveys were conducted from June 21 through August 21, 2000 on approximately 80 miles of streams draining into the Teton River. A few stream were re-visited in October to evaluate dam building activity. This assessment evaluated current channel conditions, suitability of habitat, and social issues. From the findings of this inventory we have identified areas where the re-introduction, supplementation, or protection of beaver populations could be beneficial to maintain stable channels, maintain riparian vegetation, reduce erosion, store sediment, and store water for late season release. Before any changes in beaver management could occur, local and social issues need to be further explored and resolved.

Wide flat willow dominated valley bottoms are typically formed by beaver dams that span the valley slowing the water and allowing fine sediment to settle out. Since these bottoms are composed of fine silts and sands they are highly susceptible to downward erosion if the dams or beaver that have built and maintained these dams are removed. If beaver are removed by browsing competition or trapping and dams fail these valley types can erode quickly releasing stored sediment. As the stream level drops shifts can also occur in the riparian plant community, if the change in water table is significant, the productive riparian areas can convert to drier upland sagebrush community types.

Since beaver were an essential component in forming the valley bottoms in some of the drainages, they are also necessary to maintain them.

Habitat Requirements

Beavers have certain habitat requirements that make some areas suitable for occupation and other areas unsuitable. Higher quality habitat leads to a greater abundance of beaver.

1. Each colony requires 0.5 miles of suitable stream habitat (Olsen and Hubert 1994).
2. Beaver colonies cannot establish without an adequate and accessible food supply (Allen 1983), which should be within 100 feet of the water (Belovsky 1984).
3. Beavers frequently use aspens 200-300 feet from the stream (Olsen and Hubert 1994) and may travel as far as 600 feet.
4. Willow, aspen, and cottonwood are preferred food sources, but when they are not available, alder, dogwood, and grasses are also used.
5. A stream flow of 0.5 cubic feet per second is near the minimum for beaver occupation of a stream (Muchmore 1975) and the flow must be permanent and relatively constant (Grasse and Putnam 1955; Allen 1983).
6. Narrow, confined valleys and steep channel slopes where there is very little riparian vegetation are not suitable for beavers and valley widths of greater than 150 feet are ideal (Allen 1983).
7. Stream gradients of less than 6% are preferred.

Benefits of Beaver

Olson and Hubert (1994) identified the following as the potential benefits beavers bring to aquatic ecosystems, primarily through dam building:

1. Elevation of water tables that enhance riparian vegetation development to trap eroded silt from adjacent lands.
2. Reduction of stream water velocity and increase of sediment deposition to reduce streambank and channel erosion.

3. Improvement of water quality as riparian vegetation intercepts nutrient and chemical contamination in runoff water.
4. Improvement of water storage and stabilization of stream flows throughout the summer and droughts.
5. Protection of downstream croplands and urban developments from floods by upstream storage structures.
6. Enhancement of fish habitat in streams by increasing water depth and production of aquatic invertebrates.
7. Improvement of habitat for waterfowl, big game, game and nongame birds, and other wildlife through vegetative development.
8. Increase in forage production, shelter, and water for domestic livestock.

Potential Problems of Beavers

The most common problems associated with beavers include:

1. Plugging drainpipes, irrigation gates, culverts, canals, ditches, bridges, and other structures.
2. Flooding of roads, pastures, croplands, trails, or other improved sites
3. Overuse and destruction of riparian habitats through cutting and competing browsers.

Methods

Unit Designation

The streams to be surveyed were broken into half-mile units and laid out on 7.5 ' topographic maps. Half-mile units were chosen because beavers generally have a home range of this size (Allen 1983). Thus, it was necessary to look at a half-mile section of stream to determine whether suitable habitat was available for beavers. The half-mile designation was based off a straight map distance which allowed the units to be marked and followed using a Magellan GPS Pioneer system in the field. Due to the straight map

distance, units were more than a half-mile in stream distance since streams contain meanders.

Stream units were numbered sequentially starting with Unit 1 at the downstream end of the stream (often at the Forest Boundary) and moving upstream. Whenever the mainstem of the stream divided into two forks, the forks were numbered independently with Unit 1 beginning at the mouth of the fork where it entered the mainstem. Tributaries were also designated in this way.

Each unit was walked in its entirety where possible and a Beaver Transplant Compatibility Matrix form (Appendix 1) was completed for each unit. If a point was reached on the stream where suitable beaver habitat was no longer available and there was no evidence from maps that suitable habitat existed further up in the drainage, then the surveys were stopped. If a designated unit bisected an existing beaver complex, the unit was extended to the end of the complex, making it slightly larger than 0.5 miles and making the next unit slightly less than 0.5 miles. The same method was used if suitable beaver habitat disappeared near the beginning or end of a unit break. One unit would be extended to include the suitable habitat and the next unit would include the unsuitable habitat. This helped to prevent having units that contained only small percentages of suitable or unsuitable habitat. Streams were surveyed only within the boundaries of the Caribou-Targhee National Forest.

Rosgen (1996) stream types were used to describe the basic channel types that were surveyed. Rosgen C and B types were surveyed. C type streams have the following characteristics: occur in broad valleys, low gradient < 2%, meandering with point bars and riffles, and frequent use of broad well defined floodplains, B type streams have the following characteristics: occur in areas of moderate relief, 2-4% gradient, moderately entrenched, with no defined floodplain.

Beaver Transplant Compatibility Matrix

A Beaver Transplant Compatibility Matrix form was used to assess the feasibility or need of introducing beavers to an area based on social, biological/ecological, and habitat suitability parameters. Three categories representing an adverse, no change, and positive impact of introducing beavers to an area were given for each parameter and evaluated for each unit. An adverse rating received a score of -1, a no change rating received a score of zero, and a positive rating received a score of one. The numbers were then entered into a spreadsheet using Microsoft Excel 2000 to calculate an overall score for the unit as a means of comparing the units to each other. A recommendation based on personal observation was also given for each unit.

Some streams were surveyed while others were only observed. A surveyed stream was one in which units were walked in their entirety and a Beaver Transplant Compatibility Matrix form filled out for each unit. Some streams and units, particularly those showing little to no potential for beaver, were observed, but complete surveys were not conducted. Observed streams were generally not walked in their entirety, but sections were looked at and notes were taken on general conditions.

For each unit, photos and notes of general conditions were taken and recorded (and are on file at the Caribou Targhee National Forest Supervisors office in Idaho Falls. Incidental measurements such as stream width, average depth, estimates of bank stability, the number of pools, and pieces of large woody debris (LWD) were recorded for most streams to describe the scale, quality, and condition of the stream. Table 1a. shows a list of the streams that were surveyed, and those that were observed, but not surveyed.

Table 1a. Streams surveyed during the beaver transplant compatibility inventory, summer 2000				
Stream Name	**Surveyed or Observed?**	**Miles Surveyed**	**# of Units Surveyed**	**Gravel Samples Taken Yes/No?**
North Moody Creek	S	6	12	Y
South Moody Creek	O	-	-	N
Moody Creek, Mainstem	O	-	-	N
Canyon Creek, N. Fk.	O	-	-	N
Canyon Creek, S. Fk.	O	-	-	N
Canyon Creek, Mainstem	S	3	6	Y
Wright Creek	S	0.5	1	N
Milk Creek	S	0.5	1	N
Packsaddle Creek, N. Fk	S	0.5	1	N
Packsaddle Creek, S. Fk	S	3	6	Y
Dude Creek	S	1	2	N
Horseshoe Creek, N. Fk	S	2	4	N
Bell Creek	S	0.5	1	N
Horseshoe Creek, S. Fk.	S	1	2	Y
Superior Creek	S	1	2	N
Horseshoe Creek, Mainstem	S	1.5	3	Y
North Twin Creek	S	0.8	2	Y
Mahogany Creek, N. Fk.	S	0.5	1	Y
Mahogany Creek, S. Fk.	S	0.5	1	Y
Mahogany Creek, Mainstem	S	1.8	4	Y
Patterson Creek	S	1.2	3	N
Grove Creek	O	-	-	N
Little Pine Creek	S	1.5	3	N
Trail Creek	S	5.5	11	Y
Mike Harris Creek	O	-	-	N
Mail Cabin Creek	S	1	2	N
Moose Creek	S	4	8	Y
Game Creek	S	.5	1	Y
Darby Creek	O	-	-	Y
Teton Creek	O	-	-	Y
South Leigh Creek	O	-	-	Y
North Leigh Creek	O	-	-	Y
Badger Creek	O	-	-	Y

Sampling of Sediment in Spawning Gravels

Substrate samples were also taken to evaluate the availability of suitable spawning sites. These samples were taken using the shovel method described by Grost (et al. 1991). The

shovel method consists of working the shovel vertically into the streambed, tilting the shovel back parallel to the water surface and then gently lifting the sample up.

The streams were walked and those areas that contained the best spawning sites were sampled. Areas targeted for sampling were pool tail areas with gravels predominately between 16 and 45mm. In some streams, samples were taken from the channel margins, as these were the only sites with velocities suitable for gravel deposition.

Samples were placed in a Tyvek bag and allowed to air dry for at least one week. Samples were then shaken through a series of standardized soil sieves with mesh openings of 0.5, 1, 2, 4, 8, 16, 25, and 45 and weighed to the nearest 0.1 grams. Table 1a. also shows those streams where gravel samples were collected.

Results and Recommendations

In the discussions below, suitable habitat refers to areas that meet all or most of the habitat requirements. For example, an area with a valley width of 100 feet may still be suitable if forage is available even though it would not be ideal. Unsuitable habitat refers to areas that are limited by one or more of the above-mentioned parameters. Unsuitable habitat areas may offer some additional forage or serve as travel corridors between suitable habitats, but beavers are not likely to form colonies in these areas.

Beaver complexes refer to areas with three or more intact dams that are functioning together to form ponds, thereby reducing stream velocity and trapping sediment. Complexes often have lodges and food caches associated with them. The greatest stream benefits from beavers occur once they have established complexes and are controlling stream flows.

North Moody Creek

Units 1, 3-8 and 12 all contain suitable beaver habitat with valley widths generally greater than 150 feet and abundant willows and aspen. All were inhabited by beavers at

one time. Old dams and past beaver influences occur throughout these units. Cattle impacts such as willow utilization, bank instability, erosion, and channel degradation caused by hoof slides, trails, and destruction of riparian vegetation are severe throughout these units. The loss of riparian vegetation and resulting erosion in some units has resulted in high levels of surface sediment embedded greater than 50% and stream temperatures as high as 23.5 ^{0}C. Entrenchment from 1-3.5 feet is frequent and bank stability is as low as 65% (Unit 7) due to both grazing and past beaver dam blowouts and instability. The stream in these units is characterized by slow pond/glide areas separated by short riffles that are often boulder strewn.

Unit 1 is the only unit with current beaver activity. In this unit, the stream is characterized by glide and pond areas formed by maintained and recently built dams separated by shallow riffles. Dense willows occur throughout the valley bottom and 300 to 400 aspens occur throughout the unit, providing both forage and large wood for stable dams. Dams currently in the process of being built will aid those already in place, creating a complex to slow water velocities and reduce entrenchment and bank instability, which is the result of both cattle impacts and natural stream energy. Current beaver dams frequently create ponds 100-150 feet long. Units 9-11 and 13 are not prime beaver habitat due to valley widths typically 90 ft or less and a general lack of suitable forage. However, these units may serve as corridors for beavers traveling between areas of suitable habitat and offer some additional forage.

North Moody Creek shows great potential for introduction of beavers if grazing issues such as willow utilization, bank instability caused by hoof slides, and the destruction of streamside vegetation can be addressed. Beavers could help raise the water table, which would enhance riparian vegetation development that in turn would trap sediment and stabilize banks. Enhancement of vegetation could also help provide more habitat and forage for wildlife. Introduction of beavers to North Moody Creek would also be beneficial to reduce stream velocity during run-off and increase sediment deposition to reduce streambank and channel erosion. A decrease in stream sediment could help create suitable spawning sites for cutthroat and brook trout. Although beavers have the

potential to increase forage and water for livestock, the current grazing practices on the creek would need to be altered before grazing and beavers would be compatible on this stream.

Suitable beaver habitat also exists on the mainstem of Moody Creek from the confluence of North and South Moody downstream to the Forest Boundary, but complete surveys were not conducted. The valley width is generally 100-150 feet and the entire valley bottom is covered by willows. Several thousand aspen within 100 feet of the stream are also present and at least one old dam is present in this area. The mainstem of Moody Creek is a potential site for introduction, but grazing impacts are significant and need to be addressed before any action is taken. As in North Moody Creek, the main concerns are willow utilization by cattle and bank instability caused by hoof slides and the destruction of streamside vegetation.

Canyon Creek

Mainstem

Old and recent beaver cuttings along with old and maintained dams occur throughout the entire length of the stream from the Forest Boundary upstream to the confluence of the North and South forks. Dams are not abundant and the majority of the ones observed were recently built or in the process of being built, indicating dam formation is important in the fall and winter, but high flows and a lack of larger wood for added stability lead to dam blowouts during spring runoff. Pools in this stream are large enough and deep enough that beavers can exist under the banks and dams are not necessary for beavers persistence. The high numbers of fresh cuttings and small food caches along the streambanks indicate good beaver activity and movement throughout the length of the stream.

Unit 2 was observed on August 14, with one dam built partially built (1.5' grade control) and another where construction had just begin (no grade control). This site was observed again on October 24, both dams were completed and two more either are in the very

beginnings of construction or have been abandoned. None of these dams are expected to withstand spring runoff.

The stream alternates between a C-type channel with riffle-pool complexes, frequent meanders, and depositional bars and a B-type channel consisting of long confined, boulder-strewn riffles. Bank stability is high at 85-95% and the channel condition is stable with excellent pools 2 to 3 feet deep that provide excellent fish habitat. However, there are long reaches where one side is a raw vertical bank with a well-developed floodplain opposite. This maybe the result of the 1997 flood as there are also large recent gravel bars. Some excellent spawning habitat also occurs behind LWD and boulder formed pools and in channel margins. The width depth ratio is very high ranging from a low of 34 to 94. Valley width averages 100-150 feet. Aspen are currently present, but generally, only 20-30 trees exist within 100 feet of the stream per unit. Bringing larger wood such as aspen or cottonwood to help stabilize dams may be a consideration, but this would require considerable time and effort to get the logs down into the canyon.

Given the good condition of the stream, beaver dams offer few benefits for Canyon Creek. The greatest benefits from the formation of stable dams would be a slowing of stream velocity to help reduce natural stream erosion at meanders and raising the water table to provide water to riparian vegetation. At this time, there is no need for introduction as the stream is in good condition and beavers are already present.

North Fork

The North Fork of Canyon Creek is not suitable for beavers due to low flows, a lack of forage, and an increasing gradient. Introduction is not recommended.

South Fork

The lower mile of the South Fork contains suitable beaver habitat similar to what is found on the mainstem of Canyon Creek. As in the mainstem, dams do not hold during spring

run-off and beavers are already present. Deep pools and stable banks allow beavers to exist without building dams and forming ponds. The stream is in good condition and introduction of beavers shows few potential benefits except for helping to slow stream velocities during run-off and spreading water to improve riparian vegetation.

Wright Creek

Due to a narrow valley (50-100 feet), low flows around 1CFS, and a lack of forage species such as aspen and willow, Wright Creek is not suitable for beavers. The riparian vegetation consists of forb-dominated communities and has experienced heavy grazing pressures in the past. Bank sliding and erosion are present, but banks are generally stable at around 80%. There is no evidence of past or present beaver activity and introduction into Wright Creek is not recommended.

Milk Creek

Introduction of beavers to Milk Creek now would not be successful under current grazing conditions. The area is heavily grazed and willows are severely impacted, decreasing the availability of forage for beavers. The destruction in streamside vegetation and hoof slides from cattle has reduced shade and cover on the stream and left banks exposed resulting in erosion and a stream system that is heavily sediment laden. Banks are estimated to be 60% stable. If grazing pressure is reduced and the riparian vegetation is allowed time to improve, Milk Creek could be a suitable site for introduction of beavers. Improved riparian conditions could help restore cattle trails, improve the food base for wildlife, provide shade and pools for fish, provide water to improve the willow community, and help store sediment thereby improving the overall condition of the stream. No past or recent beaver activity was observed during the survey.

Packsaddle Creek

Surveys were conducted on the North and South forks of Packsaddle Creek.

North Fork

The valley width is less than 50 feet, forage species such as willow and aspen are limited, and the gradient quickly increases making the North Fork unsuitable for beavers. Introduction is not recommended in this area.

South Fork

Units 1-3 and 6 are not prime habitat for beaver. In these units, the valley bottom is typically only as wide as the channel and forage species such as willow and aspen are greatly lacking. The riparian area is dominated by conifers and dogwood and the channel is stable at 95%, consisting of riffle-pool complexes and pools formed by LWD.

Unit 4 contains an old beaver complex with numerous old dams. Many of the dams are still in good condition, but at the time of the survey, there was no evidence to suggest recent activity in the area. Long glide areas between beaver ponds are storing high amounts of fine substrates and thereby decreasing downstream sedimentation. The lower 0.25 miles of Unit 5 also looks like excellent beaver habitat and old cuttings are present, but there was no sign of recent activity. In the upper 0.25 miles of Unit 5, the valley width narrows from 400 feet to 50 feet and a forest riparian consisting of conifers and dogwood replaces the willow community found in the lower half of this unit. In both units 4 and 5, banks are 90-95% stable and bank instability appears to be natural, generally only occurring at meanders. Valley widths range from 150-400 feet in the area suitable for beavers. The 0.75-mile section of stream consisting of Unit 4 and the downstream half of Unit 5 would make a good site for introduction. Beavers in this area could help provide water to riparian vegetation, help stabilize flows to reduce seasonal fluctuations, and store water for late season release. Another potential benefit is that beavers introduced to this area will take over maintenance of the dams currently there and prevent the release of stored sediment and uncontrolled channel and bank erosion.

Dude Creek

Unit 1 is in a transition from a "G" gully type channel to a "C" type channel. It receives pressure from both cattle and sheep as evidenced by columnar shrubs and a forb dominated vegetative community consisting of coneflower, stinging nettle, cow parsnip, thistle, timothy, and Kentucky bluegrass. The channel has entrenched in the past, but currently appears stable and is healing with bank stability at 85%. Willows are virtually absent from this unit and it does not appear suitable for beavers.

Unit 2 is the site of an old beaver complex, possibly 50-60 years ago. All dams are revegetated and there is no evidence of recent activity. This unit appears to be improving from both a riparian and channel condition standpoint, but receives pressure from both sheep and cattle grazing. Flow limitations and a general lack of forage species make introduction impractical at this time. Introduction of beavers to this area would be better in the future, allowing time for forage species to improve.

Horseshoe Creek

Surveys were conducted on the mainstem, North Fork, and South Fork of Horseshoe Creek along with two tributaries: Bell and Superior creeks.

Mainstem

The mainstem of Horseshoe Creek is suffering from active erosion and bank instability, and the channel has entrenched 2-4 feet. A wide valley bottom and dense willows make this excellent beaver habitat. Beaver activity could enhance the stream by reducing stream water velocity and increasing sediment deposition to reduce streambank and channel erosion.

Active beaver complexes currently exist in Units 1 and 2. Unit 3 has six old dams that would have formed a complex .25 miles in length. As beaver numbers increase, they should move in and re-occupy this area. Although more beaver activity could further enhance the condition of the stream, introduction at this time is not a necessary course of action given that beavers already appear to be well established and natural expansion will occur if they are not removed.

The mainstem of the Horseshoe Creek was revisited on Oct. 16, 2000 to verify if any dam building activity had occurred since it was surveyed in June. In the June survey in unit 1 only two active dams were observed. In Oct. a series of nine dams were observed backing water from below the Forest Boundary upstream .25 miles forming an almost continuous complex. If these dams fail during runoff measures such as the importation of aspen logs, need to be taken to reinforce the dams to recover the damaged banks in this area.

A stream capture event was also documented 100 yds upstream of the confluence of the South Fork and Horseshoe Creek. A culvert has failed and an old road has captured the stream channel. Severe erosion is occurring in about 150 feet of channel due to unauthorized ATV use. This site could be repaired rather easily with a rubber-tired backhoe.

South Fork

Suitable beaver habitat exists in Unit 1of the South Fork of Horseshoe Creek. The available forage consists of mostly willow although 100-200 3-6 inch aspen are dispersed throughout the unit. Beavers may have used this unit in the past, as there is some evidence of cutting, but no evidence of dam building. The existing stream in this unit is entrenched, but it appears stable. Beavers currently occupy the lower half of Unit 2 near the entrance of Superior Creek. Only one maintained beaver dam providing a grade control of 3 feet exists on the South Fork, but a large beaver complex exists at the mouth of Superior Creek. The upper half of unit 2 turns into a conifer-dominated forest and the

stream is dominated by large woody debris. Few willows exist in this portion of the unit and it is not prime beaver habitat. Given the active beaver complex at the mouth of Superior Creek and the complexes located in the mainstem of Horseshoe Creek, over time beavers if not removed should occupy all suitable habitat along the South Fork and introduction would not be necessary.

North Fork

The majority of the North Fork of Horseshoe Creek is not prime beaver habitat. Entrenchment sometimes exceeding 4 feet in depth is leading to bare, eroding banks, particularly in Unit 1. However, an active complex does occur at the downstream end of Unit 2. Entrenchment is not evident near this beaver complex and the valley is 150 to 200 feet wide and contains abundant willows. Approximately one quarter mile upstream of the beaver complex, the valley becomes confined and the valley width narrows to only 20-30 feet in this unit. In this area, the stream is dominated by riffle-pool complexes, LWD, and a riparian forest consisting mostly of conifers and dogwood. An old beaver marsh with dams that are largely revegetated also occurs at the upstream end of Unit 3. If beaver were to re-colonize these dams, they could provide some valuable wildlife habitat. The stream is characterized by shallow glides and the marsh is storing high amounts of sediment. Upstream of this marsh, the valley once again narrows and willows disappear making the rest of the North Fork unsuitable for beavers. Given the recent activity of beavers in the Horseshoe Creek drainage and shooting risks, there is no need for introduction in this area.

Bell Creek

From the confluence with the North Fork of Horseshoe Creek upstream to the Horseshoe Creek trail crossing, the creek is incised approximately 2 feet. This portion of the stream is mostly shallow riffles and runs. The bottom is silt covered and few pools exist. Approximately 0.15 miles upstream from the confluence with the North Fork, there is a pond, but it does not appear to be formed by beavers and no beaver activity was

observed. This entire area is a willow marsh with multiple creek or spring channels, some of which have dried up. One-quarter mile upstream from the confluence with the North Fork, Bell Creek enters a conifer forest and willows disappear making the rest of the creek unsuitable for beavers. Low flows and only a quarter mile of suitable habitat on Bell Creek limit beavers from inhabiting and forming complexes in this area.

Superior Creek

An active beaver complex is located at the mouth of Superior Creek where it enters the South Fork of Horseshoe Creek. The complex is characterized by extremely dense willows, deep beaver ponds, and a valley width of 400 feet. Mud appears to be an important component of dams in this unit and many dams are overgrown with vegetation and cover much of the valley bottom. Building wide expansive dams in this unit allows beavers to disperse stream energy during spring flows. Dissipation of stream energy allows willow dams to hold and larger wood such as aspen is not needed. Upstream of the complex, the habitat quickly becomes unsuitable for beaver due to a narrowing of the valley from 400 feet to 30 feet and a change from a willow to a dogwood and conifer dominated riparian. Beavers currently occupy the suitable habitat available in Superior Creek and introduction is not necessary.

North Twin Creek

The lower 0.15 miles of Unit 1 is an incised channel that is entrenched from 3-4 feet. Willows are present in the valley along with grasses, dogwood, and hawthorne. Areas consisting of only forbs such as coneflower show evidence of over grazing. The unit appears to be recovering from past grazing and no recent evidence of cattle was observed although some plants (particularly dogwood) have been recently browsed. Sediment appears high and substrate surfaces are often >50% embedded. Beaver cuttings that look older than 50 years are present, and three or four areas may have been past dam sites.

The upper 0.35 miles of this unit enters a riparian forest dominated by dogwood although willows still occur and are abundant. In this section, LWD is very prominent and banks are 95% stable with excellent pools occurring in the channel. No beaver activity past or present was observed in this portion of the unit except in the upper 0.05 miles where remnants of an old dam exist and willows become more abundant. Due to low flows and a confined valley with a narrow valley bottom, this is not an ideal site for introduction of beavers. Although suitable, North Twin Creek is not prime beaver habitat and introduced beavers will seek out better habitat in nearby drainages.

Mahogany Creek

Surveys were conducted on the mainstem, North Fork, and South Fork of Mahogany Creek.

Mainstem

Excellent beaver habitat occurs throughout the length of mainstem Mahogany Creek. Both old and recent dams are frequent. Active beaver complexes currently exist in Units 1, 2, and 4 and dams containing large aspen logs provide up to 4 feet of grade control. The mainstem of Mahogany Creek alternates between a C-type depositional channel with valley widths ranging from 150-600 feet and a B-type channel with valley widths of only 50 feet. Where the valley is wide, dense willow and aspen occur and beavers are highly active.

The lower half of Unit 1 is in very poor condition with entrenchment of 1-5 feet occurring and bank stability of only 40-50%. Bank sliding, erosion, and exposed banks are common in this unit. The poor condition appears to be the result of a beaver influenced area where a series of old dams (some as high as 4.5') have either blown out or been purposefully removed in an effort to control collection of water at the diversion. Options need to be evaluated to determine if there are measures that could be taken to meet the needs of the irrigators to divert water and still maintain channel stability. Bank

stability upstream greatly improves to 85-95% and entrenching is no longer evident. Beaver ponds formed by dams are up to 4 feet deep and storing high amounts of sediment. Despite the high amount of sediment storage, substrates throughout Mahogany Creek are extremely sediment laden both in riffles and in pools. The sources of this high sediment load are not clear and needs further investigation. Channel conditions generally improve upstream. Introduction of beavers is not necessary as beavers are present and highly active.

North Fork

Unit 1of the North Fork of Mahogany Creek is a past beaver influenced area with multiple old dams, but no recent activity. Dams are generally not intact, revegetated, and only noticeable by numerous beaver cuts extending from underneath the bank. It appears a lack of beaver in this stream has led to entrenchment of 3-4 feet and banks that are only 70-75% stable. It appears where old dams have blown out, the water level has dropped and banks have been exposed. Beavers could help elevate the water table, enhance riparian vegetation, increase sediment deposition and storage, and reduce current streambank and channel erosion, making the North Fork a potential site for introduction.

Upstream of Unit 1, the valley narrows, willows disappear, and a riparian forest takes over making the habitat unsuitable for beaver. At the lower end of this unit where the North Fork meets the South Fork, the stream cascades through a B-type channel as the stream drops down a hill via a waterfall. In this section, the valley is only as wide as the channel and although this section is less than 0.05 miles long, it may discourage beavers from re-colonizing the North Fork naturally since migration is most often by water.

South Fork

Only the lower 0.2 miles of the South Fork contains suitable beaver habitat consisting of a valley width greater than 150 feet and a willow complex. Upstream of the lower 0.2 miles, the stream changes from a C to a B type channel dominated by LWD, the valley

narrows to 40-50 feet, and a dense riparian dogwood and conifer forest overhangs the stream. Beavers utilize the lower 0.2 miles of the South Fork as evidenced by fresh beaver cuttings and a small food cache. However, no dams were found and there is not enough suitable habitat to support a colony of beavers. The South Fork is not prime beaver habitat and is not a recommended site for introduction.

Patterson Creek

Units 1 and 2 of Patterson Creek consist mostly of gravels, small cobble substrates, and frequent pools formed by LWD or at meanders. Sediment accumulation appears high in pools and sometimes in riffles, although a few good spawning gravel sites are present at pool tailouts. Willows are abundant except in areas where evidence of grazing occurs. In these areas, forbs and grasses are the dominant riparian species. Pools up to 2 feet deep are present and banks are 75-80% stable with instability occurring where stream crossing and hoof slides result in instability, bare banks, and erosion. Beavers used this unit in the past at least for cutting, but no recent activity was observed. Valley width in Units 1 and 2 is 100-150 ft.

The lower half of Unit 3 shows grazing impacts as indicated by forb dominated communities and bank instability and erosion caused by cattle trails and hoof slides. Substrates are generally gravels and smaller cobbles, but sediment deposition appears substantial and often appears to enter the stream at hoof slides. Entrenchment up to 2 feet is evident in this unit. In the upper 0.25 miles of this unit, the gradient increases and the valley narrows making it unsuitable for beavers.

Units 1 and 2 contain suitable beaver habitat and old cuttings and dams are present. Unit 2 contains a small beaver complex with several old dams. However, no recent activity was observed anywhere on the creek. Unit 3 is not highly suitable for beaver, but may offer some additional forage. Introduction is a possible course of action on this creek. A potential advantage of introducing beavers to this creek is the storage of water for release throughout the summer when flows are greatly reduced. Beavers could also elevate the

water table to improve the riparian vegetation in open grazed areas for both wildlife and cattle and could store sediment entering the stream from hoof slides and trail crossings to improve stream quality downstream.

Little Pine Creek

Unit 1 of Little Pine Creek contains a very active beaver complex. The first 0.1-mile lacks beaver and has entrenchment of 1 to 4 feet. The next 0.1-mile contains a vigorous complex with fresh cuttings, food caches, well-worn beaver trails, lodges, and at least 10 maintained dams which form large deep ponds. The valley width in this area is approximately 200 feet and willows dominate the vegetation. This complex is very susceptible to trapping as it is highly visible from a well-traveled paved road.

Unit 2 is the site of an old beaver complex containing multiple dams, but no recent activity is occurring in this unit. The valley width in this unit is only 70-100 feet, but willows are very abundant and old cuttings and dams are numerous and occur frequently. The entire unit is entrenched 1 to 3.5' and bank stability is 70-80%. An old dam is still intact with a 6' head cut stopping at the dam. This instability continues about 800 feet downstream to a stable carex meadow. Substrates are highly sediment laden. Coal Mine Creek is the main source of water at the confluence with Little Pine and it has had beaver activity in the past.

The active complex in Unit 1 is separated from the old complex in Unit 2 by a 0.3-mile corridor of unsuitable beaver habitat with a narrow valley and dense vegetation. There appears to be no movement between the two complex sites. The old complex site in Unit 2 is a recommended site for introduction. Re-introduction maybe unnecessary if the complex in unit 1 is not trapped and allowed to naturally expand upstream. Restoring beavers to this area could reduce streambank degradation and erosion by slowing run-off and help elevate the water table improving riparian vegetation, and arresting the head cut. Another potential benefit is the formation of deeper pools for fish.

Trail Creek

Surveys were conducted on the mainstem of Trail Creek and in two tributaries: Mike Harris and Mail Cabin Creeks.

Mike Harris

The lower 0.3 miles of Mike Harris Creek has habitat suitable for beavers with a valley width of 100-200 ft and dense willows. Upstream of this, the valley narrows and the stream enters an area dominated by riparian forest. It appears beavers utilized the lower 0.3 miles of Mike Harris Creek in the past as evidenced by old cuttings but no recent activity occurs here. Mike Harris could be easily re-colonized by beaver from Trail Creek.

Mainstem

Beaver activity occurs throughout the entire length of Trail Creek as evidenced by recent cuttings, food caches, bank dens, and beaver trails, but high flows and a lack of larger wood may limit the formation of stable dams. Deep pools allow beavers to exist without building dams and forming ponds. The most suitable areas for beaver occur between Mike Harris Campground and Trail Creek Campground (Units 2 through 5) where a wide valley bottom (200-400ft) and dense willows exist. Upstream of these units the stream alternates between narrow valley forest dominated communities and wider valley, willow dominated communities. The channel and bank conditions within this reach are highly variable. Bank stability is difficult to estimate where banks are vertical with little vegetation since they are obscured by overhanging willow branches.

Unit 1 from the Mike Harris Bridge downstream to the irrigation diversion the channel has been straightened and confined. This has resulted in entrenchment of the streambed and lack of pool habitat.

Unit 2 is stable with areas of large boulders and an accessible floodplain. Highway construction has confined and straightened short sections of the stream. There are two sites visible from the highway where there are 3.5’ raw vertical banks but opposite of

these is a well-vegetated developed floodplain. In another section of a straightened stream, there is a right angle turn with a 80-100' section of entrenchment.

Unit 3 begins along yet another straightened section of stream that has entrenched 3.3-4.5' and is continuous for about .25 mile including a significant meander cutoff. The next .1 mile is eroding on the outside meanders with the opposite bank and floodplain vegetated and accessible.

Unit 4 contained the first active dam in the main channel at a height of 3.5 feet. There was also another dam and pond off channel in this unit. There are many spots in this unit where it appears dams were once built. On October 26, a freshly pelted beaver carcass was found near the main channel dam. The accessibility of this area by the Teton Pass road and the visibility of any large dams from the road make this area susceptible to trapping. This units bank stability was estimated at less than 50% with entrenchment of 4' being common for .4 miles. The banks have a heavy growth of willow with vertical banks with little to no vegetation other than overhanging willow branches making the banks appear stable.

Unit 5 has sites where the outside meander bends have vertical banks up to 6' high but the opposite banks were well vegetated with an accessible floodplain.

Unit 6 also has one dam within the unit.

In areas where the valley bottom is narrow and not formed by beaver activity, the banks are more stable. Most of Trail Creek has excellent pool habitat with frequent meanders. Where beaver dams occur, they store sediment and improve the water quality downstream.

Introduction of beavers is recommended, as there are neither beaver complexes present nor signs of reproducing family units. Units 4 and 5 are the best sites for introduction. The establishment of complexes in this area would serve to elevate the water table and

arrest the entrenchment that is occurring. The same processes that built the wide willow bottoms would continue. The addition of larger wood such as aspen may be needed to provide structural strength to the dams until beaver complexes once again dissipate stream energy by spreading floodwater over the willow bottom. Unit 3 may not be a good site for re-introduction as the entrenchment is related to straightening of the stream channel associated with highway construction.

Stable dams could raise water level, trap sediment and slow stream velocities thereby reducing entrenchment and bank erosion caused by high flows. They could also help trap sediment from moving downstream. Substrates generally looked clean and unembedded. However, significant amounts of fines are entering Trail Creek from the closed Mail Cabin Creek road due to a stream capture and from several gully areas where water runs through culverts and down road fills associated with Wyoming State Road 22 making alluvial deposits into the stream (see photo).

Mail Cabin Creek

Mail Cabin Creek does not contain suitable beaver habitat due to a narrow valley (<50 feet) and a lack of willows and other forage species, and no beaver activity was observed. Accumulation of fines beneath the top layer of substrates appears high and a road capture at the mouth of the stream where it enters Trail Creek is contributing sediment. Introduction to this stream is not recommended.

Moose Creek

Beavers are present throughout the creek as indicated by recent cuttings, trails, burrows, and small food caches but high flows limit dam formation for much of the creek. Beaver complexes currently exist in units 9, 10, and 12. Much of the creek is located in the Jedediah Smith Wilderness Area and is in near pristine condition. Since beavers already occupy areas of the creek where the valley opens and willows are abundant, there is no need for introduction at the present time.

Game Creek

Only one unit (Unit 6) was surveyed on this creek, as much of the stream is unsuitable beaver habitat due to a narrow valley, high flows, and a lack of suitable forage. Unit 6 is located in the Jedediah Smith Wilderness and is in pristine condition. The main channel is a B-type channel with large cobble substrates that are clean and unembedded. Banks are 95% stable. The valley width in this unit is 200-250 feet and two small beaver complexes occur here. Both are located in side channels, as main channel dams likely do not hold during spring runoff and high flows. Large wood for stable dams is not highly abundant. Beavers currently exist in the suitable habitat areas of Game Creek and the stream is in excellent condition. Introduction of beavers is not necessary.

Other Creeks

Darby, Teton, South Leigh, North Leigh, and Badger Creeks were observed, but complete surveys were not conducted on these streams. Darby, Teton, and South Leigh Creeks showed no evidence of beaver activity. Old cuttings were present in Badger Creek, but there was no other sign of beaver activity along this stream. North Leigh Creek contains a large beaver complex at the lower end of the stream near the Forest Boundary, but beaver activity becomes absent upstream. In all of these creeks, high flows, narrow canyons, and a general lack of forage species such as willow and aspen make them unsuitable for beavers. Grove Creek was not suitable for beavers due to limited flows and lack of available forage.

Sampling of Sediment in Spawning Gravels

Substrate particle sizes below 8 mm in size have been shown to impede emergence of fry. Samples that had a cumulative percent by weight that averaged above 25% for particles smaller than 4 mm were considered to be spawning impaired with sediment levels that are likely above natural levels. The 4 mm size was chosen to be more conservative since natural levels have not been determined. Bjornn (1991) reports declines in emergence of young fish for increasing levels of sediment, at 20% (85-55% survival) and significant declines at 30% sediment (15-60% survival) and virtually no survival above 40% sediment (0-5% survival). The following streams had sediment levels above 25% for at least some of the portions we sampled and are considered spawning impaired: Packsaddle, Horseshoe, North Twin, Mahogany, Trail, North Leigh, and Badger Creeks (Table 1b.).

These point samples only evaluate the best spawning sites that were found and may not indicate the sediment conditions of the whole stream. For example, North Moody was sampled 5.5 miles upstream above the confluence with South Moody. In this area there are not a lot of impacts versus down lower in the watershed where there are more roads and grazing impacts with high levels of visible surface sediment. No fish data was taken

with these sediment samples. It may be beneficial in the future to correlate the presence of young of the year trout to sediment levels.

Table 1b. Streams sampled for sediment in spawning gravels, summer 2000

Stream Name	Number of Samples	Average Cumulative % by weight < 4 mm		Standard Deviation For < 4 mm
		<4 mm	<8 mm	
North Moody Creek, 5.5 miles above Forest Boundary	6	17	31	10
Canyon Creek, Mainstem	6	20	36	8
Packsaddle Creek, S. Fk	6	29	44	6
Horseshoe Creek, S. Fk.	6	26	39	6
Horseshoe Creek, Mainstem	6	20	30	8
North Twin Creek	6	31	44	6
Mahogany Creek, N. Fk.	3	29	43	5
Mahogany Creek, S. Fk.	3	16	29	8
Mahogany Creek, above trailhead	6	27	46	7
Mahogany Creek, at Forest boundary	6	29	44	7
Trail Creek, at Coal Creek	6	30	42	10
Trail Creek, above Mike Harris	6	23	37	7
Moose Creek, Trailhead	2	25	39	8
Game Creek	6	15	27	10
Darby Creek, above trailhead	6	20	31	13
Darby Creek, above Forest Boundary	6	12	23	11
Teton Creek, above Campground	6	15	23	7
Teton Creek, above Forest Boundary	6	25	38	11
South Leigh Creek, above trailhead	6	22	33	11
South Leigh Creek, above Forest Boundary	6	18	27	7
North Leigh Creek, above trailhead	6	21	34	7
North Leigh Creek, below trailhead	6	27	38	5
Badger Creek,	6	26	35	8

Conclusions *(see also the executive summary)*

Potential watershed problems could be remedied by the addition of beavers to certain streams. The areas most suitable for beavers and showing the greatest potential benefits include North Moody Creek, the South Fork of Packsaddle Creek, the North Fork of Mahogany Creek, Patterson Creek, Little Pine Creek, and Trail Creek.

This study identifies specific areas where beaver populations could be enhanced or expanded to benefit stream and riparian function. This report serves to share the results of our inventory with our partners. With our partners, we will next determine the social concerns and needs and how these concerns can be resolved. We will determine what other information or studies may be needed. It is also recommended that the partners evaluate the possible benefits and disadvantages of more closely managing beaver on certain streams on National Forest lands. Through proper management of beaver populations, stream and riparian conditions will improve.

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Appendix II. Data Tables

Appendix I. Data Tables